

CMPT 260 Midterm Exam
November 8, 2005
10.am. Closed Book. 90 minutes

Instructions. Please answer all questions in the exam booklet. A portion of the marks awarded will be for the style and clarity of your answer. Marks will not be awarded in proportion to the length of an answer. Marks are indicated in boldface.

Do not use a light pencil.

1. **(10)** Construct the truth table for $(P \vee (Q \wedge \neg R)) \Rightarrow ((P \vee Q) \wedge \neg R)$.
2. **(10)** Prove that $(A \vee (B \vee C)) \vdash (\neg B \Rightarrow (A \vee C))$.
3. **(10)** Prove $(A \Leftrightarrow B) \Rightarrow ((A \wedge C) \Rightarrow (B \wedge C))$.
4. **(10)** “Some retired persons are wealthy. Some wealthy people donate money. Therefore some retired people donate money.”

Represent the above as a sentence of first order logic.

Is the sentence contradictory, valid or satisfiable? If the sentence is contradictory or valid, show that it is false/true under all interpretations. If it is satisfiable, give interpretations that make it true and false.

5. **(10)** Give the definition of addition. Using only this definition, and induction, show that $(a+b)+n = a+(b+n)$.
6. **(10)** Assume all the axioms and theorems of addition and multiplication. Provide a definition for exponentiation, and show that $a^m a^n = a^{m+n}$.
7. **(10)** Write a Prolog predicate *honourRoll*(*N*,*L1*,*L2*), where, if *L1* is a list of list-pairs, each pair consisting of a student and a mark, *L2* is a list of students with marks higher than *N*. For example:

```
?- honourRoll( 65, [[smith,79],[chan,81],[peder,64]], L).  
L=[smith,chan]  
?- honourRoll( 95, [[alder,79],[chan,81],[dane,64]], L).  
L=[ ]
```

-End of Exam-